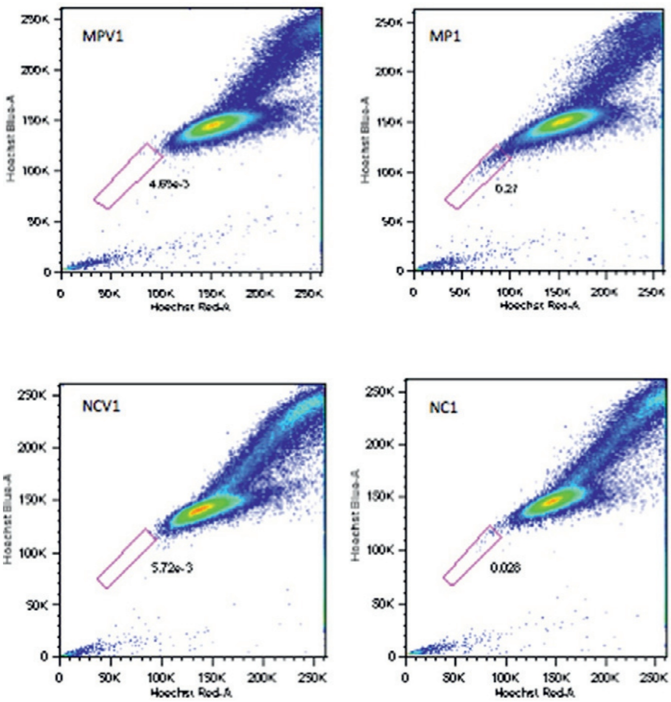

Fig. 2: Flow cytometry for SP assay with Hoechst dye concentration of 2.5 μ g/ml. Top: side population of MP-like cells, with the ratio of 0.27% (MP1). The side population is eliminated with verapamil (MPV1). Bottom: side population of normal chondrocytes, with the ratio of 0.028%.

94
RELATIONSHIP BETWEEN HIP ADDUCTION MOMENT, HIP ABDUCTOR STRENGTH AND PROGRESSION OF KNEE OSTEOARTHRITIS

C.O. Kean, K.L. Bennell, K. Bowles, R.S. Hinman. *Univ. of Melbourne, Melbourne, Australia*

Purpose: Previous research had found that an increased hip adduction moment during walking was protective of knee osteoarthritis (OA) progression (based on radiographic medial joint space grading). It is speculated that this is due to stronger hip abductor muscles which help stabilize the pelvis on the stance limb and prevent pelvic drop of the swing limb. If the hip abductors of the stance limb are weak, the pelvis may drop towards the contralateral swing limb resulting in a shift of the centre of mass away from the stance limb, thereby increasing the frontal plane lever arm at the knee and subsequently increasing the peak knee adduction moment, a proxy for medial compartment loading. The purposes of this study were to examine the relationship between baseline a) hip adduction moment and b) hip abductor strength, and changes in cartilage morphology over 12 months in people with medial knee OA.

Methods: 200 individuals with medial knee OA were recruited for a clinical trial evaluating the efficacy of lateral wedge insoles on slowing structural disease progression. Since the wedges had no effect on symptoms or structural changes, data from 144 participants (71 lateral wedge insoles, 73 control insoles; 72% of participants) who completed a three-dimensional gait analysis, as well as baseline and follow-up MRIs, were pooled for the current study. A subset of participants from the control insoles group (n = 49) also underwent hip abductor strength testing at baseline. Sagittal MR knee images were obtained on a 1.5-T whole body unit. Annual change in tibial cartilage volume was determined by subtracting the follow-up volume from baseline volume and dividing by time between scans. Progression of cartilage defects and bone marrow lesions (BMLs) was determined by subtracting the cartilage defect/BML grade at follow-up from that at baseline. A value less than or equal to −1 represented progression. A multiple linear regression model was used to examine the relationship between hip adduction moment (independent variable) and annual change in medial tibial cartilage volume (dependent variable). Binary logistic regressions were used to examine the association between hip adduction moment (independent variable) and progression of tibiofemoral cartilage defects and BMLs (dichotomized dependent variables). Analyses were repeated using hip abductor strength as the independent variable. All models were initially adjusted for age, sex, body mass index and repeated with additional covariates of intervention group, MRI machine and alignment.

Results: Baseline hip adduction moment during walking and hip abductor strength were not associated with either change in medial tibial cartilage volume or progression of medial tibiofemoral cartilage defects or BMLs (Table 1).

Table 1. Relationship between hip adduction moment, abductor strength and change in cartilage

	Univariate analysis		Multivariate analysis*		Multivariate analysis**	
	Regression coefficient (95% CI)	P value	Regression coefficient (95% CI)	P value	Regression coefficient (95% CI)	P value
Annual change medial tibial cartilage volume						
Peak hip adduction moment (%BW*ht)	2.26 (−3.26, 7.77)	0.42	3.95 (−2.92, 10.82)	0.26	3.78 (−3.15, 10.72)	0.29
Hip abduction strength (Nm/kg)	3.79 (−32.53, 40.10)	0.84	8.57 (−32.75, 49.89)	0.68	0.68 (−41.56, 42.95)	0.97
	Odds ratio (95% CI)	P value	Odds ratio (95% CI)	P value	Odds ratio (95% CI)	P value
Progression of Medial Tibiofemoral Cartilage Defects (yes/no)						
Peak hip adduction moment (%BW*ht)	1.08 (0.84, 1.39)	0.55	1.09 (0.79, 1.49)	0.36	1.09 (0.79, 1.51)	0.60
Hip abduction strength (Nm/kg)	1.27 (0.09, 2.54)	0.78	0.72 (0.13, 4.14)	0.72	0.73 (0.13, 4.28)	0.73
Progression of Medial Tibiofemoral BMLs (yes/no)						
Peak hip adduction moment (%BW*ht)	0.91 (0.72, 1.16)	0.46	0.93 (0.69, 1.25)	0.63	0.93 (0.69, 1.26)	0.64
Hip abduction strength (Nm/kg)	0.01 (0.01, 1.55)	0.10	0.07 (0.00, 1.4)	0.08	0.06 (0.00, 1.33)	0.08

95% CI = 95% confidence interval.
*adjusting for age, gender, body mass index.
** adjusting for age, gender, body mass index, intervention group, MRI machine and alignment.

Conclusions: These findings suggest that neither an increased hip adduction moment nor increased hip abductor strength is protective against change in cartilage volume/morphology in medial knee OA. These findings are consistent with recent hip strengthening intervention studies which have found that increased hip abductor strength does not alter the knee adduction moment.

95
KNEE ALIGNMENT MAY INFLUENCE PERI-ARTICULAR BONE MORPHOLOGY

G.H. Lo[1,2], T.E. McAlindon[3]. [1]*Michael E. DeBakey Dept. of Veteran's Affairs Med. Ctr., Houston, TX, USA;* [2]*Baylor Coll. of Med., Houston, TX, USA;* [3]*Tufts Med. Ctr., Boston, MA, USA*

Purpose: Static alignment influences loading in the knee joint and is a potent predictor of disease progression in those with osteoarthritis (OA). The peri-articular bone has a major role in force dispersion across the knee and changes in its structure, both adaptive and pathological, are prominent in OA. However, the interplay between knee biomechanics and the state of the peri-articular bone is not fully understood. Our objective was to evaluate the influence of static knee joint alignment on peri-articular trabecular morphology measured by MRI and on bone mineral density (BMD) using dual x-ray absorptiometry (DXA).

Methods: This was a cross-sectional analysis of 320 enrollees into the Osteoarthritis Initiative (OAI) Bone Ancillary Study, who received trabecular MRI and peri-articular bone mineral density (paBMD) measurements of one knee at the Ancillary baseline visit (parent study 30 or 36 month visits) who also had comprehensive physical exams at the parent study 24 month visits that included goniometric evaluation of static alignment, where negative values were valgus and positive varus. A correction factor was applied to the physical exam static alignment measures to more closely represent mechanical alignment. Knee and femoral neck DXAs were obtained using GE Lunar Prodigy DXA scanners at the Ancillary baseline. Knee DXAs were used to measure an absolute medial tibial peri-articular bone mineral density (paBMD) and a medial:lateral tibial paBMD ratio.

Trabecular morphometry MRIs were also obtained at Ancillary baseline using 3T MRIs. The medial tibial periarticular bone was analyzed using a customized software package (calcDCN) to provide measures of total bone volume fraction (tBVF), trabecular number, spacing and thickness (Tb.N, Tb.Sp, and Tb.Th).

We performed Pearson's correlations to evaluate associations of static alignment with trabecular morphometry measures, paBMD, medial:lateral tibial paBMD ratio, femoral neck BMD, age, and body mass index (BMI). We also performed subgroup analyses among those without and with radiographic evidence of OA (Kellgren/Lawrence grade <2 v. ≥2).